Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-44 (canceled)

Claim 45 (previously presented): Apparatus for amplifying an optical signal, said apparatus comprising:

a pump system disposed to inject optical pump energy into a first end of a first fiber segment so as to counter-propagate relative to an optical signal traversing said first fiber segment and a second fiber segment; and

an optical filter structure coupled to a second end of said first fiber segment and a first end of said second fiber segment; and

wherein said optical signal propagates through said optical filter structure from said second fiber segment to said first fiber segment, said optical pump energy propagates through said optical filter structure from said first fiber segment to said second fiber segment, and said optical filter structure substantially blocks energy at frequencies about an optical pump energy frequency, including a frequency of said optical signal, from traveling from said first fiber segment into said second fiber segment so that Raman amplification is induced in said first fiber segment and said second fiber segment and double Rayleigh backscattering effects are ameliorated.

Claim 46 (previously presented): Apparatus for amplifying an optical signal, said apparatus comprising:

a pump system disposed to inject optical pump energy into a first end of a first fiber segment so as to counter-propagate relative to an optical signal traversing said first fiber segment and a second fiber segment; and

an optical filter structure coupled to a second end of said first fiber segment and a first end of said second fiber segment, said optical filter structure further comprising:

a circulator having a first port, a second port, and a third port; and

a fiber Bragg grating configured to reflect optical energy at a frequency of said optical pump energy and to absorb optical energy at a frequency of said optical signal;

wherein said optical signal propagates through said optical filter structure from said second fiber segment to said first fiber segment, said optical pump energy propagates through said optical filter structure from said first fiber segment to said second fiber segment, and said optical filter structure substantially blocks energy at a frequency of said optical signal from traveling from said first fiber segment into said second fiber segment so that Raman amplification is induced in said first fiber segment and said second fiber segment and double Rayleigh backscattering effects are ameliorated.

Claim 47 (previously presented): The apparatus of claim 46 wherein said optical pump energy enters said third port of said circulator from said first fiber segment, exits said first port of said circulator, reflects from said fiber Bragg grating into said first port of said circulator and exits said second port of said circulator into said second fiber segment.

Claim 48 (previously presented): The apparatus of claim 46 wherein reflections of said optical signal enter said third port of said circulator from said first fiber segment, exit said first port of said circulator and are not reflected by said fiber Bragg grating.

Claim 49 (previously presented): The apparatus of claim 46 wherein said optical signal enters said second port of said circulator from said second fiber segment and exits said third port of said circulator into said first fiber segment.

Claim 50 (previously presented): The apparatus of claim 46 further comprising:

an isolator coupled to a second end of said first fiber segment and configured to pass optical energy into said first fiber segment via said second end and block optical energy from exiting said first fiber segment via said second end.

Claim 51 (previously presented): The apparatus of claim 46 further comprising:

said first fiber segment and said second fiber segment.

Claim 52 (previously presented): Apparatus for amplifying an optical signal, said apparatus comprising:

a pump system disposed to inject optical pump energy into a first end of a first fiber segment so as to counter-propagate relative to an optical signal traversing said first fiber segment and a second fiber segment; and

an optical filter structure coupled to a second end of said first fiber segment and a first end of said second fiber segment; and

an additional optical filter structure coupled to a second end of said second fiber segment and a first end of a third fiber segment,

wherein said optical signal propagates through said optical filter structure from said second fiber segment to said first fiber segment, said optical pump energy propagates through said optical filter structure from said first fiber segment to said second fiber segment, and said optical filter structure substantially blocks energy at a frequency of said optical signal from traveling from said first fiber segment into said second fiber segment so that Raman amplification is induced in said first fiber segment and said second fiber segment and double Rayleigh backscattering effects are ameliorated; and wherein said optical signal propagates through said additional optical filter structure from said third fiber segment to said second fiber segment, said optical pump energy propagates through said additional optical filter structure from said second fiber segment to said third fiber segment, and substantially blocks energy at a frequency of said optical signal from traveling from said second fiber segment into said third fiber segment so that Raman amplification is also induced in said third fiber segment.

Claim 53 (previously presented): The apparatus of claim 46 wherein said optical pump energy comprises:

a first optical pump signal at a first frequency; and

a second optical pump signal at a second frequency.

Claim 54 (currently amended): A method for amplifying an optical signal, said method comprising:

injecting optical pump energy into a first end of a first fiber segment so that said optical pump energy counter-propagates relative to an optical signal traversing said first fiber segment and a second fiber segment, wherein injecting optical pump energy further comprises:

injecting a first optical pump signal at a first frequency; and

injecting a second optical pump signal at a second frequency different than said first frequency;

passing said optical signal from said second fiber segment into a second end of said first fiber segment;

passing said optical pump energy from said first fiber segment into said second fiber segment; and

blocking optical energy at frequencies about an optical pump energy frequency, including a frequency of said optical signal, from entering said second fiber segment from said first fiber segment.

Claim 55 (previously presented): A method for amplifying an optical signal, said method comprising:

injecting optical pump energy into a first end of a first fiber segment so that said optical pump energy counter-propagates relative to an optical signal traversing said first fiber segment and a second fiber segment;

passing said optical signal from said second fiber segment into a second end of said first fiber segment which comprises

passing said optical signal from a first end of said second fiber segment into a second port of a circulator and out a third port of said circulator into said second end of said first fiber segment;

passing said optical pump energy from said first fiber segment into said second fiber segment; and

blocking optical energy at a frequency of said optical signal, from entering said second fiber segment from said first fiber segment.

Claim 56 (previously presented): A method for amplifying an optical signal, said method comprising:

injecting optical pump energy into a first end of a first fiber segment so that said optical pump energy counter-propagates relative to an optical signal traversing said first fiber segment and a second fiber segment;

passing said optical signal from said second fiber segment into a second end of said first fiber segment;

passing said optical pump energy from said first fiber segment into said second fiber segment which comprises:

passing said optical pump energy from said second end of said fiber segment into a third port of a circulator and out a first port of said circulator;

reflecting said optical pump energy from a fiber Bragg grating and back into said first port of said circulator, out said second port of said circulator and into said second fiber segment; and

blocking optical energy at a frequency of said optical signal, from entering said second fiber segment from said first fiber segment.

Claim 57 (previously presented): A method for amplifying an optical signal, said method comprising:

injecting optical pump energy into a first end of a first fiber segment so that said optical pump energy counter-propagates relative to an optical signal traversing said first fiber segment and a second fiber segment;

passing said optical signal from said second fiber segment into a second end of said first fiber segment;

passing said optical pump energy from said first fiber segment into said second fiber segment; and

blocking optical energy at a frequency of said optical signal, from entering said second fiber segment from said first fiber segment which comprises:

passing said optical energy at said frequency of said optical signal into a third port of a circulator and out of said second port of said circulator; and

absorbing said optical energy at a Fiber Bragg grating.

Claim 58 (previously presented): The method of claim 55 further comprising employing an isolator to block said optical pump energy from exiting a second end of said second fiber segment while permitting said optical signal to enter said second end of said second fiber segment.

Claim 59 (previously presented): The method of claim 55 wherein injecting optical pump energy comprises:

injecting a first optical pump signal at a first frequency; and

injecting a second optical pump signal at a second frequency different than said first frequency.

Claim 60 (currently amended): Apparatus for amplifying an optical signal, said apparatus comprising:

means for injecting optical pump energy into a first end of a first fiber segment so that said optical pump energy counter-propagates relative to an optical signal traversing said first fiber segment and a second fiber segment; wherein said optical pump energy comprises a first pump signal at a first frequency and a second pump signal at a second frequency different than said first frequency;

wavelength-selective means for reflecting optical energy at a frequency of said pump energy, optical energy at a frequency of said optical signal being absorbed by said wavelength-selective reflecting means; and

means for directing optical energy exiting a first end of said second fiber segment into a second end of said first fiber segment, for directing optical energy exiting said second end of said first fiber segment into said wavelength-selective reflecting means, and for directing optical energy reflecting from said wavelength-reflective means into said first end of said second fiber segment.

Claims 61-63 (cancel)

Claim 64 (currently amended): The apparatus of claim ~~63~~ 60 wherein said wavelength-selective reflecting means comprises:

a first fiber Bragg grating configured to reflect optical energy at said first frequency; and

a second fiber Bragg grating configured to reflect optical energy at said second frequency.

Claim 65 (previously presented): The apparatus of claim 52 wherein said optical filter structure comprises:

a first circulator having a first port, a second port, and a third port; and

a first fiber Bragg grating configured to reflect optical energy at a frequency of said optical pump energy and to absorb optical energy at a frequency of said optical signal; and wherein said additional optical filter structure comprises:

a second circulator having a first port, a second port, and a third port; and

a second fiber Bragg grating configured to reflect optical energy at a frequency of said optical pump energy and to absorb optical energy at a frequency of said optical signal.

Claim 66 (previously presented): The apparatus of claim 65 wherein said optical pump energy enters said third port of said first circulator from said first fiber segment, exits said first port of said first circulator, reflects from said first fiber Bragg grating into said first port of said first circulator and exits said second port of said first circulator into said second fiber segment; and wherein said optical pump energy enters said third port of said second circulator from said second fiber segment, exits said first port of said second circulator, reflects from said second fiber Bragg grating into said first port of said second circulator and exits said second port of said second circulator into said third fiber segment.

Claim 67 (previously presented): The apparatus of claim 65 wherein reflections of said optical signal enter said third port of said first circulator from said first fiber segment, exit said first port of said first circulator and are not reflected by said first fiber Bragg grating; and wherein

reflections of said optical signal enter said third port of said second circulator from said second fiber segment, exit said first port of said second circulator and are not reflected by said second fiber Bragg grating.

Claim 68 (previously presented): The apparatus of claim 65 wherein said optical signal enters said second port of said second circulator from said third fiber segment and exits said third port of said second circulator into said second fiber segment; and wherein said optical signal enters said second port of said first circulator from said second fiber segment and exits said third port of said first circulator into said first fiber segment.

Claim 69 (previously presented): The apparatus of claim 52 further comprising:

an isolator coupled to a second end of said first fiber segment and configured to pass optical energy into said first fiber segment via said second end and block optical energy from exiting said first fiber segment via said second end.

Claim 70 (previously presented): The apparatus of claim 52 further comprising:

said first fiber segment, said second fiber segment and said third fiber segment.

Claim 71 (previously presented): The apparatus of claim 52 wherein said optical pump energy comprises:

a first optical pump signal at a first frequency; and

a second optical pump signal at a second frequency.

Claim 72 (previously presented): The apparatus of claim 45 wherein said optical filter structure comprises:

a circulator having a first port, a second port, and a third port; and

a fiber Bragg grating configured to reflect optical energy at said optical pump energy frequency and to absorb optical energy at a frequency of said optical signal.

Claim 73 (previously presented): The apparatus of claim 46 wherein said optical pump energy enters said third port of said circulator from said first fiber segment, exits said first port of said circulator, reflects from said fiber Bragg grating into said first port of said circulator and exits said second port of said circulator into said second fiber segment.

Claim 74 (previously presented): The apparatus of claim 72 wherein reflections of said optical signal enter said third port of said circulator from said first fiber segment, exit said first port of said circulator and are not reflected by said fiber Bragg grating.

Claim 75 (previously presented): The apparatus of claim 72 wherein said optical signal enters said second port of said circulator from said second fiber segment and exits said third port of said circulator into said first fiber segment.

Claim 76 (previously presented): The apparatus of claim 45 further comprising:

an isolator coupled to a second end of said first fiber segment and configured to pass optical energy into said first fiber segment via said second end and block optical energy from exiting said first fiber segment via said second end.

Claim 77 (previously presented): The apparatus of claim 45 further comprising:

said first fiber segment and said second fiber segment.

Claim 78 (previously presented): The apparatus of claim 45 further comprising:

an additional optical filter structure coupled to a second end of said second fiber segment and a first end of a third fiber segment;

wherein said optical signal propagates through said additional optical filter structure from said third fiber segment to said second fiber segment, said optical pump energy propagates through said additional optical filter structure from said second fiber segment to said third fiber segment, and substantially blocks energy at frequencies about said optical pump frequency, including a frequency of said optical signal, from traveling from said second fiber segment into

said third fiber segment so that Raman amplification is also induced in said third fiber segment and double Rayleigh backscattering effects are ameliorated.

Claim 79 (previously presented): The apparatus of claim 45 wherein said optical pump energy comprises:

a first optical pump signal at a first frequency; and

a second optical pump signal at a second frequency.

Claim 80 (previously presented): The method of claim 56 further comprising employing an isolator to block said optical pump energy from exiting a second end of said second fiber segment while permitting said optical signal to enter said second end of said second fiber segment.

Claim 81 (previously presented): The method of claim 56 wherein injecting optical pump energy comprises:

injecting a first optical pump signal at a first frequency; and

injecting a second optical pump signal at a second frequency different than said first frequency.

Claim 82 (previously presented): The method of claim 57 further comprising employing an isolator to block said optical pump energy from exiting a second end of said second fiber segment while permitting said optical signal to enter said second end of said second fiber segment.

Claim 83 (previously presented): The method of claim 57 wherein injecting optical pump energy comprises:

injecting a first optical pump signal at a first frequency; and

injecting a second optical pump signal at a second frequency different than said first frequency.

Claims 84-88 (cancel)